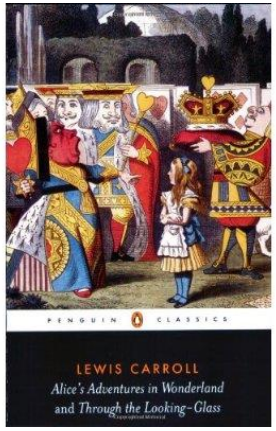

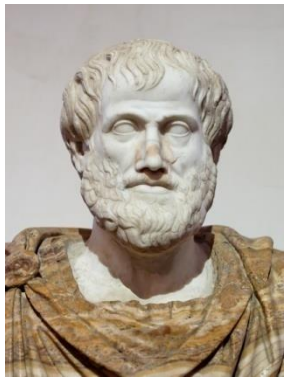

COMP 1002

Intro to Logic for Computer Scientists

Lecture 1

B 5 2 J

Admin stuff

- Lectures: Mon, Tue and Thu, 1pm.
- Labs: Mondays and Wednesdays 9am.
  - There will be no labs for the first week or two.
- Course website: follow the link from www.cs.mun.ca/~kol
- Questions:
  - Office hours?
  - Comp 1000?
  - Week away in March?

Marking scheme

- Lab quizzes: 24% total (~9 labs)
  - on D2L (Brightspace). In the last hour of the lab.
  - Lowest lab mark dropped.
- Assignments: 5 x 6%
  - Last assignment might be due during last week.
- Midterm: 15%
- Final exam: 31%
  - We might have a practice final

Do we think logically?

- You see the following cards. Each has a letter on one side and a number on the other.

- Which cards do you need to turn to check that if a card has a J on it then it has a 5 on the other side?

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Do we think logically?

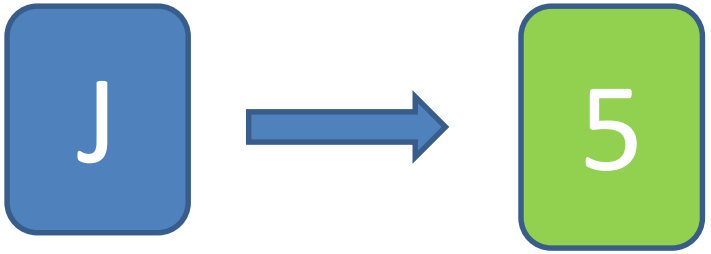
- You see the following cards. Each has a letter on one side and a number on the other.

- Which cards do you need to turn to check that if a card has a J on it then it has a 5 on the other side?
  - All cards where J is visible.
  - Plus all cards with a number other than 5 visible.

“if … then” in logic

- This puzzle has a logical structure:

“if A then B”



- What circumstances make this true?
  - A is true and B is true

  - A is true and B is false

  - A is false and B is true

  - A is false and B is false

If A then B

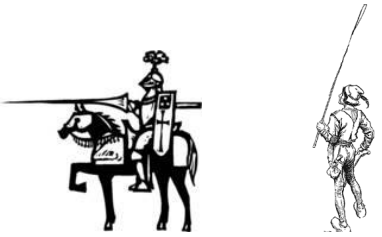
- We make logical conclusions all the time
- But do we always make them “logically”?
- Sometimes people think that “if ... then” goes both ways...
  - If you live in NL, you must pay HST. John lives in BC. Does he pay HST?
  - If today it Tuesday, then there is a COMP1002 lecture. Today is Thursday. Is there a COMP1002 lecture today?

Natural vs. Logic language

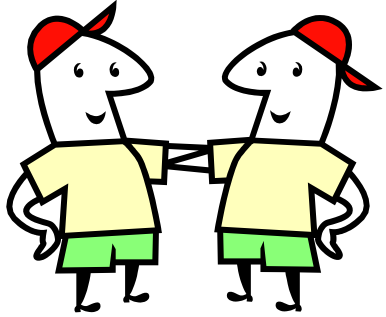
- Natural languages are ambiguous.
- For example, the word “any” can have different meanings depending on the context:

- Any = some
  - She will be happy if she can solve any question.
  - She will be happy if she can solve every question.

- Any = all
  - Any student knows this.
  - Every student knows this.

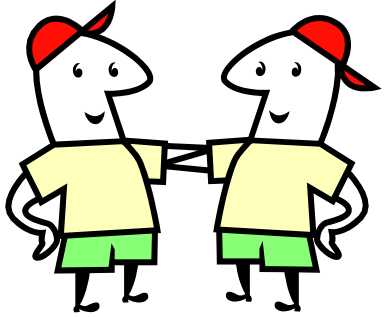


Twins puzzle



- There are two identical twin brothers, Dave and Jim.
- One of them always lies; another always tells the truth.
- Suppose you see one of them and you want to find out his name.
- How can you learn if you met Dave or Jim by asking just one short yes-no question? You don’t know which one of them is the liar.

Twins puzzle



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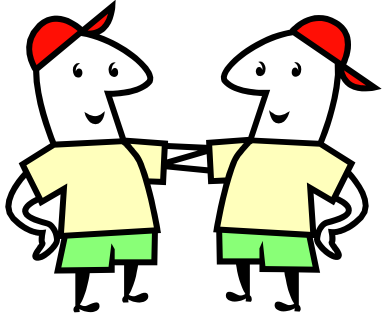
This is Jim	Jim is a liar				
Yes	Yes				
Yes	No				
No	Yes				
No	No				

Twins puzzle



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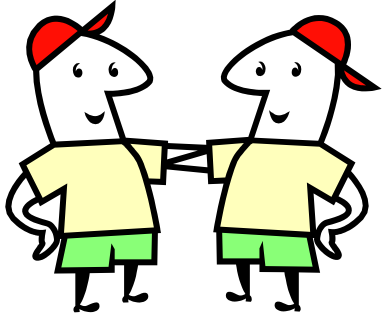
This is Jim	Jim is a liar	This is a liar			
Yes	**Yes**	Yes			
Yes	**No**	No			
No	**Yes**	No			
No	**No**	Yes			

Twins puzzle



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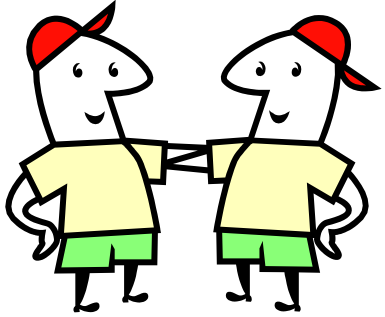
This is Jim	Jim is a liar	This is a liar	Are you Jim?		
Yes	**Yes**	No	No		
Yes	**No**	No	Yes		
No	**Yes**	Yes	No		
No	**No**	Yes	Yes		

Twins puzzle



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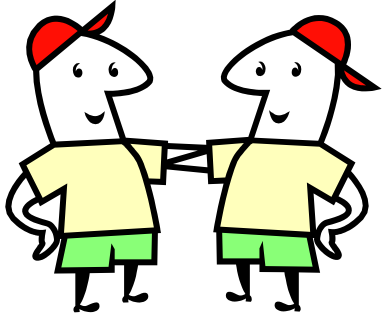
- How can you learn if you met Dave or Jim by asking just one short yes-no question? You don't know which one of them is the liar.

This is Jim	Jim is a liar	This is a liar	Are you Jim?	Is 2+2=4?	
Yes	**Yes**	Yes	No	No	
Yes	**No**	No	Yes	Yes	
No	**Yes**	No	No	Yes	
No	**No**	Yes	Yes	No	

Twins puzzle



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This is Jim	Jim is a liar	This is a liar	Are you Jim?	Is 2+2=4?	Is Dave a liar?
Yes	**Yes**	Yes	No	No	Yes
Yes	**No**	No	Yes	Yes	Yes
No	**Yes**	No	No	Yes	No
No	**No**	Yes	Yes	No	No

Language of logic: building blocks

- **Proposition**: A sentence that can be *true* or *false.*
  - A: “It is raining in St. John’s right now”.
  - B: “2+2=7”
  - But not “Hi!” or “what is x?”
- **Propositional variables:**
  - A, B, C (or p, q, r)
  - It is a shorthand to denote propositions:
    - “B is true”, for the B above, means “2+2=7” is true.

Language of logic: connectives

Pronunciation	Notation	Meaning
Not A (negation)	$\neg$ A	Opposite of A is true, $\neg$A is true when A is false
A and B (conjunction)	A $\wedge$ B	True if both A and B are true
A or B (disjunction)	A $\vee$ B	True if either A or B are true (or both)
If A then B (implication)	A $\rightarrow$ B	True whenever if A is true, then B is also true

- Let A be "It is sunny" and B be "it is cold"
  - $\neg$ A: It is not sunny
  - A $\wedge$ B: It is sunny and cold
  - A $\vee$ B: It is either sunny or cold
  - A $\rightarrow$ B: If it is sunny, then it is cold

- Can build longer formulas by combining smaller formulas using connectives.
  - And parentheses: will see later when can remove them.